

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE									
LOWER ARM ASSEMBLY, ITEM 103 ----- 0103-212123-13/14 (2)	2/1R	103FM17 Loss of primary cam pin of restraint bracket, loss of retention screw. Material defect: Bracket, retention screw, cam pin.	END ITEM: Loss of primary axial restraint. GFE INTERFACE: Axial load will be transferred to secondary restraint. MISSION: None. CREW/VEHICLE: None with single failure. Loss of crewman with loss of secondary restraint. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Days. REDUNDANCY SCREENS: A-PASS B-N/A C-PASS	A. Design - The cam bracket and primary pin are fabricated from 17-4 stainless steel bar stock. The bracket and pin are heat treated to a condition H-1050, ultrasonically cleaned, passivated and either electropolished or dry hone finished. The primary cam pin has a 16 finish to preclude restraint webbing abrasion. The primary cam pin adjusts to allow increase or decrease in axial length of the primary webbing. A spring and ball detent system allows for positioning of the cam pin. The cam pin is retained by two 17-4 stainless steel retention screws. Analysis of the restraint bracket cam pin shows a minimum ultimate strength of 840 lbs and a yield strength of 765 lbs. At 4.4 psid (normal operating pressure) the S/AD limit load is 219 lbs., giving the bracket pin a minimum safety factor of 3.8 for ultimate and 3.5 for yield. At 5.5 psid (max failure pressure) and 8.8 psid (max BTA operating pressure) the bracket pin provides safety factors for ultimate of 4.1 and 5.3 respectively. The S/AD minimum safety factor for hardware at 4.4 psid is 2.0 for ultimate and 1.5 for yield. At both 5.5 psid and 8.8 psid, the S/AD minimum safety factor for hardware is 1.5 for ultimate. Rotation of the cam pin can only occur in one direction. The axial load of the primary restraint when pressurized reacts in the opposite direction of the direction of the designed rotation, hence inadvertent rotation while pressurized is precluded. Loss of the lower arm wrist disconnect retention screw is precluded in design by adherence to standard engineering torque requirements. B. Test - Acceptance: Component - See Inspection. PDA: The following tests are conducted at the Lower Arm Assembly level in accordance with ILC Document 0111-710112: 1. Proof pressure test at 8.0 +0.2 -0.0 psig to verify no structural damage. Certification: The cam bracket was successfully tested (manned) during SSA certification to duplicate 458 hours operational life (Ref. ILC Report 0111-711330). The following usage, reflecting requirements of significance to the cam bracket, was documented during certification: <table border="1"> <thead> <tr> <th>Requirement</th> <th>S/AD</th> <th>Actual</th> </tr> </thead> <tbody> <tr> <td>Don/Doff</td> <td>98</td> <td>400</td> </tr> <tr> <td>Pressure Hours</td> <td>458</td> <td>916</td> </tr> </tbody> </table> C. Inspection - Components and material manufactured to ILC requirements at an approved supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the material received are as identified in the procurement documents, that no damage has occurred during shipment and that	Requirement	S/AD	Actual	Don/Doff	98	400	Pressure Hours	458	916
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		103FM17		<p>supplier certifications have been received which provide traceability information.</p> <p>The bracket castings are radiographically inspected to detect the presence of flaws prior to machining and magnetic particle inspected after machining. The brackets that are machined from bar stock are magnetic particle inspected to detect the presence of flaws.</p> <p>The following MIP's are performed during the wrist disconnect assembly manufacturing process to assure the failure cause is precluded from the fabricated item:</p> <ol style="list-style-type: none">1. Visually inspect the wrist disconnect restraint bracket during the manufacturing process. <p>During PDA, the following inspection points are performed at the Arm Assembly level in accordance with ILC Document 0111-710112:</p> <ol style="list-style-type: none">1. Verify, by visual inspection, no structural damage following proof pressure test.2. Inspection for cleanliness to VC level.3. Visual inspection for damage, wear or material degradation. <p>D. Failure History - None.</p> <p>E. Ground Turnaround - None for every component which is within its limited life requirements.</p> <p>Also, every four years or 229 hours of manned pressurized time, during lower arm maintenance, the primary and secondary restraint brackets are removed and reinstalled, during which time loctite application and screw torque are verified.</p> <p>F. Operational Use - Crew Response - Pre EVA: No response, single failure undetectable by crew. Continue EVA prep. EVA: No response, single failure undetectable by crew. Continue EVA. Training - No training specifically covers this failure mode. Operational Considerations - Not applicable.</p>

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-103 ARM ASSEMBLY
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

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